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## (54) Protective cushion for protection of vehicle occupant's head

(57) The object is to provide a protective cushion for protection of vehicle occupant's head which can be sufficiently prevented from gas leakage so as to maintain the inner pressure high over a lengthy period in time and, in addition, can be smoothly inflated and deployed. In order to achieve this object, a protective cushion (30) has a protective cushion element (31) and outer shell fabrics (51, 52) superposed on both outer surfaces of the protective cushion element (31). A cabin-side base fabric (32) and a window-side base fabric (33) are sewn together by sewing yarns after bonded to each other by adhesive (39). The outer shell fabrics (51, 52) are bonded to the protective cushion element (31) by adhesive (55). The adhesive (55) is applied to the outer surfaces of the protective cushion element (31) into a narrow band shape along line-shaped joint (40) to cover the line-shaped joint (40) extending along the outer peripheral edge of the protective cushion element (31).

Fig. 1

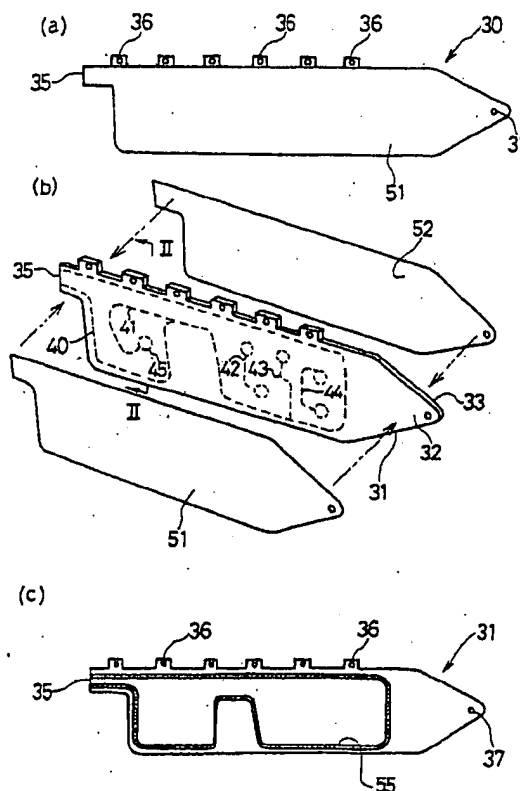
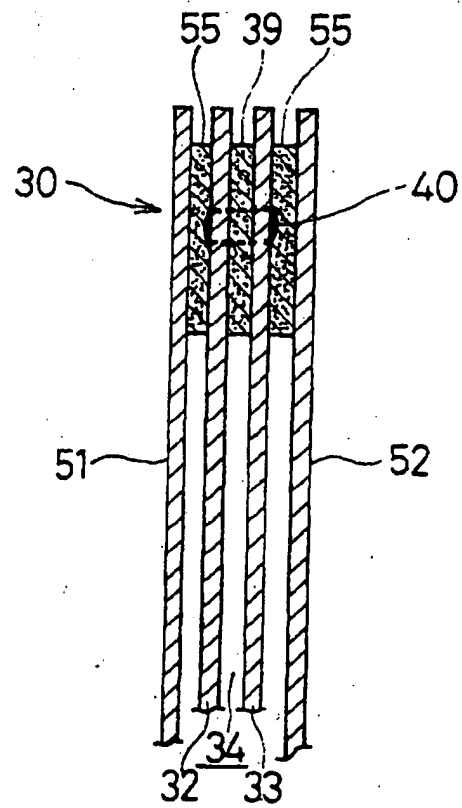


Fig. 3



## Descripti n

### [Industrial Field of the Invention]

[0001] The present invention relates to a protective cushion for protection of a vehicle occupant's head and, more particularly, to a cushion which is folded and disposed along an upper corner of a side of a vehicle cabin in the normal state and is inflated into a curtain shape to expand over windows of side doors and a B-pillar in the event of a side impact collision or roll-over of a vehicle.

### [Related Art]

[0002] As one of protective cushions for protection of occupant's head, there is a so-called curtain airbag which is folded and disposed along an upper corner of a side of a vehicle cabin in the normal state (when a vehicle is not in the emergency situation such as the event of a vehicle collision) and is inflated into a curtain shape to expand over windows of side doors and a B-pillar in the event of a side impact collision or roll-over of a vehicle. As one of protective cushions of this type, there is an air cushion comprising two base fabrics which are joined together along their peripheries by line-shaped joint by stitches of sewing yarns to form a chamber between the base fabrics. The chamber is designed to be filled with gas.

[0003] With reference to Figs. 6(a)-6(c), description will be made as regard to the structure of a conventional protective cushion of this type for protection of vehicle occupant's head. Fig. 6(a) is a front view of a protective cushion 1 for protection of vehicle occupant's head according to a conventional example, Fig. 6(b) is a sectional view taken along a B-B line of Fig. 6(a), and Fig. 6(c) is a sectional view taken along a C-C line of Fig. 6(a).

[0004] The protective cushion 1 of this conventional example comprises a cabin-side base fabric 2 and a window-side base fabric 3 which are superposed and sewn to each other so as to form a chamber 4 between the base fabrics 2 and 3. The base fabrics 2, 3 may be separated pieces or may be one piece which is folded in half.

[0005] The base fabrics 2, 3 are joined to each other by line-shaped joint 10 extending around their peripheries (with some parts thereof extending inward of the base fabrics 2, 3), line-shaped joints 11, 12 for subdividing the chamber 4, and circular joints 13 for reinforcing areas around ends of the line-shaped joints 11, 12. Each of the circular joints 13 has a circular opening 14 formed at the center thereof by cutting out the base fabrics 2, 3.

[0006] The cushion 1 extends along the side of the vehicle cabin in the longitudinal direction of the vehicle. The cushion 1 is provided at the front end and the rear end in the longitudinal direction thereof with projecting portions 16, 18 which are formed with holes 17, 19 for

installation to the vehicle body, respectively. The cushion 1 is provided along the upper edge thereof with a plurality of projections 20 which are also formed with holes 21 for installation to the vehicle body, respectively.

[0007] A gas inlet 5 through which gas from an inflator (not shown) is introduced is formed at the front end or the rear end (the rear end in this conventional example) of the cushion 1. It should be understood that the position of the gas inlet 5 is not limited thereto and the inflator may be disposed inside the cushion.

[0008] The line-shaped joint 11 is apart from the line-shaped joint 10 extending along the cushion. Each end of the line-shaped joint 11 are respectively connected to the circular joints 13.

[0009] The upper and lower ends of the line-shaped joint 12 both are apart from the line-shaped joint 10 extending along the upper edge and the lower edge of the cushion and both are connected to the circular joints 13, respectively. The line-shaped joints 11, 12 prevent the chamber 4 from being inflated too thick. The circular joints 13 reinforce the ends of the line-shaped joints 11, 12.

[0010] For example, the cushion 1 is installed in such a manner that the projecting portion 16 at the front end is fixed to an A-pillar of the vehicle by bolts or rivets through the holes 17 thereof, the projecting portion 18 at the rear end is fixed to a C-pillar by a bolt or rivet through the hole 19 thereof, and the projections 20 along the upper edge are fixed to a roof side rail by bolts or rivets through the holes 21 thereof. The cushion 1 is arranged along the upper corner of the vehicle side surface in the state folded along the roof side rail (Fig. 6(a)).

[0011] The folded cushion 1 is covered by a cover (not shown). The cover is adapted to be torn or opened when the cushion 1 is inflated.

[0012] As the vehicle suffers a side impact collision or roll-over, the inflator (not shown) is actuated, gas flows into the chamber 4 through the gas inlet 5 so that the cushion 1 is inflated and deployed downwardly along the side surface of the vehicle cabin into the curtain shape, thereby protecting the head of occupant.

[0013] By the way, as for protective cushions of this type for protection of vehicle occupant's head, it is preferable to maintain the cushion in the inflated state over a lengthy period in time amounting to at least several seconds not only for prevention of collision of the occupant's head to the window glass or the B-pillar at the instant of the side impact collision of the vehicle but also for protection of the occupant just after the roll-over of the vehicle.

[0014] When the protective cushion for protection of vehicle occupant's head is inflated over the window glasses, there is possibility that the cushion is damaged by fragments of window glasses broken by a vehicle collision or roll-over so as to reduce the inner pressure of the cushion. Therefore, it is preferable that the protective cushion is provided with measures for coping with this.

[0015] As a protective cushion with such measures, Japanese Patent Unexamined Publication No. 11-310097 discloses a cushion with dual structure comprising a protective cushion for protection of vehicle occupant's head and an outer cushion in which the protective cushion is accommodated.

[0016] As explained concretely, the cushion of the above publication is "a cushion having dual structure constituted of an outer cushion made of a woven fabric and an airtight inner cushion both having nearly the same shape when inflated. The outer cushion and the inner cushion are not bonded to each other".

#### [Problems to be resolved by the Invention]

[0017] However, since the outer cushion and the inner cushion are not bonded to each other at all, the outer cushion may not follow the movement of inflation of the inner cushion and may sometimes disturb the inflation of the inner cushion.

[0018] It is an object of the present invention to provide a protective cushion for protection of vehicle occupant's head of which base fabrics are sufficiently protected from fragments of window glasses and the inflation thereof can be smoothly conducted and which can be sufficiently prevented from gas leakage through sewn portions with sewing yarns so as to maintain the inner pressure high over a lengthy period in time.

#### [Means to Solve the Problems]

[0019] According to the present invention, this object is achieved by a protective cushion having the features of claim 1. The dependent claims define preferred and advantageous embodiments of the invention.

[0020] The protective cushion for protection of vehicle occupant's head of the present invention is a cushion which is fixed at its upper portion to a portion near the corner between a ceiling and a side surface of a vehicle cabin and which is inflated downwardly along the side surface by gas. The protective cushion comprises a cabin-side base fabric and a window-side base fabric which are sewn together by sewing yarns and is characterized in that outer shell fabrics are superposed on outer surfaces of said cabin-side base fabric and said window-side base fabric, respectively, and the outer shell fabrics are bonded by adhesive to at least one of sewn portions formed with sewing yarns for joining the cabin-side base fabric and the window-side base fabric.

[0021] In the protective cushion for protection of vehicle occupant's head having the aforementioned structure, since the outer shell fabrics are bonded to the cabin-side base fabric and the window-side base fabric along the sewn portions by the adhesive, the outer shell fabrics securely follow the movement of inflation of a cushion element composed of the cabin-side base fabric and the window-side base fabric so as to deploy smoothly, whereby the protective cushion can be ex-

tremely smoothly inflated as a whole.

[0022] The inflated protective cushion is prevented from being damaged by fragments of window glasses because the cabin-side base fabric and the window-side base fabric are shielded by the outer shell fabrics. The outer shell fabrics are bonded via the adhesive to the sewn portions joining the cabin-side base fabric and the window-side base fabric. Because of the sealing efficiency of the adhesive, the gas leakage through the sewn portions can be prevented.

[0023] According to the present invention, it is preferable that the cabin-side base fabric and the window-side base fabric are sewn together at least along their peripheries, and the outer shell fabrics are bonded by adhesive to the sewn portion along the peripheries. Since the peripheries of the outer shell fabrics are bonded to the cabin-side base fabric and the window-side base fabric, the outer shell fabrics securely follow the movement of inflation of the cushion composed of the cabin-side base fabric and the window-side base fabric. In addition, this arrangement facilitates the folding of the protective cushion in the state that the outer shell fabrics, the cabin-side base fabric, and the window-side base fabric are superposed on each other.

[0024] According to the present invention, the cabin-side base fabric and the window-side base fabric are bonded together by adhesive at portions to be sewn and then sewn together at said portions by said sewing yarns. According to this arrangement, the gas sealing property at the sewn portions is further improved.

#### [Brief Explanation of the drawings]

[0025] Figs. 1(a)-1(c) are illustrations for explaining a protective cushion for protection of vehicle occupant's head according to an embodiment of the invention.

[0026] Figs. 2(a), 2(b) are sectional views taken along a line II-II of Fig. 1(b).

[0027] Fig. 3 is an enlarged view of a portion III of Fig. 2(a).

[0028] Fig. 4 is an illustration for explaining another embodiment of the invention.

[0029] Figs. 5(a), 5(b) are illustrations for explaining further another embodiment of the invention.

[0030] Figs. 6(a)-6(c) are structural views for a protective cushion according to a conventional example.

#### [Embodiments for carrying out the Invention]

[0031] Hereinafter, embodiments of the present invention will be described with reference to the attached drawings. Fig. 1(a) is a side view of a protective cushion for protection of vehicle occupant's head according to an embodiment, Fig. 1(b) is an exploded perspective view of the same, Fig. 1(c) is an illustration for explaining an application portion of adhesive, and Figs. 2(a), 2(b) are sectional views taken along a line II-II of Fig. 1(b) wherein Fig. 2(a) shows the non-inflated state and Fig.

2(b) shows the inflated state. Fig. 3 is an enlarged view of a portion III of Fig. 2(a).

**[0032]** A protective cushion 30 for protection of vehicle occupant's head according to the embodiment comprises a protective cushion element 31, and outer shell fabrics 51, 52 superposed on the both side surfaces of the protective cushion element 31.

**[0033]** In this embodiment, the protective cushion element 31 comprises a cabin-side base fabric 32 and a window-side base fabric 33 which are sewn to each other by sewing yarns so as to form a chamber 34 between the base fabrics 32 and 33. The base fabrics 32, 33 are joined to each other by joints formed with sewing yarns including a line-shaped joint 40 extending around their peripheries (with some parts thereof extending inward of the base fabrics 32, 33), line-shaped joints 41, 42, 43, 44 for subdividing the chamber 34, and circular joints 45 for reinforcing areas around ends of the line-shaped joints 41-44. In this embodiment, the cabin-side base fabric 32 and the window-side base fabric 33 are bonded to each other by adhesive 39 and, after that, are sewn together by sewing yarns. The protective cushion element 31 is provided at the rear end thereof with a gas inlet 35 for introduction of gas from an inflator (not shown).

**[0034]** The protective cushion element 31 is provided along the upper edge thereof with a plurality of projections 36 for installation of the protective cushion 30 to a vehicle body such as a roof side rail. The projections 36 are formed with holes for insertion of bolts, respectively. The protective cushion element 31 is provided at the front end thereof with holes 37 for installation to an A-pillar.

**[0035]** The outer shell fabrics 51, 52 have nearly the same shape as the cabin-side base fabric 32 and the window-side base fabric 33, except that they do not have projections. It should be noted that the outer shell fabrics 51, 52 may have any shape capable of substantially entirely covering the inflatable portions of the protective cushion element 31. The outer shell fabrics 51, 52 may be made of the same fabric of the protective cushion element 31 and is preferably made of relatively thin fabric of, for example, 70-210 deniers in order to reduce the volume of these in the folded state as small as possible. In addition, it is preferable that at least one of the surfaces of each outer fabric 51, 52 is coated by silicone resin or the like.

**[0036]** The outer shell fabrics 51, 52 are bonded to the protective cushion element 31 by adhesive 55. In this embodiment, the adhesive 55 is applied to the outer surface of the protective cushion element 31 into a narrow band shape along the line-shaped joint 40 to cover the line-shaped joint 40 extending along the outer peripheral edge of the protective cushion element 31. Silicone resin adhesive made of the same material as the adhesive 39 used for the line-shaped joint 40 and the like of the protective cushion element 31.

**[0037]** The protective cushion 30 for protection of ve-

hicle occupant's head is fixed to the vehicle body in the folded state by the holes of the projections 36 and the hole 37 at the front end. The protective cushion 30 for protection of vehicle occupant's head is covered by a cover (not shown). The cover is adapted to be torn or opened when the protective cushion 30 is inflated. The cover may be a roof garnish of the vehicle.

**[0038]** As the vehicle suffers a side impact collision or roll-over, the inflator is actuated, gas flows into the chamber 34 through the gas inlet 35 so that the cushion 30 is inflated and deployed downwardly along the side surface of the vehicle cabin, thereby protecting the head of the occupant. During this, since the inner pressure of the chamber 34 of the protective cushion element 31 is increased because of the inflation with gas and plunge of the head of the occupant, extremely large stress may be concentrated on the line-shaped joints 40-44 and the circular joints 45 which are formed by adhesive and sewing.

**[0039]** Since the outer shell fabrics 51, 52 are bonded to the protective cushion element 31 along the line-shaped joint 40 by the adhesive 55, the outer shell fabrics 51, 52 follow the movement of inflation of the protective cushion element 31 so as to deploy smoothly, whereby the protective cushion 30 can be smoothly inflated as a whole.

**[0040]** Since the adhesive 55 is applied to portions along the line-shaped joint 40 of the protective cushion element 31 which is formed by sewing, needle holes which were formed in the surfaces of the protective cushion element 31 during the sewing process for the line-shaped joints of the protective cushion element 31 are filled with the adhesive 55 and are covered by the outer shell fabrics 51, 52, thereby securely preventing the gas leakage through the portions.

**[0041]** The inflated protective cushion element 31 of the protective cushion 30 for protection of vehicle occupant's head is prevented from being damaged by fragments of window glasses because the cushion element 31 is shielded by the outer shell fabrics 51, 52. Even when the adhesives 39 are detached or flocculated and broken due to the strong expanding pressure and the stress concentration, the sewing yarn of the line-shaped joint 40 is covered by the adhesive 55 on the outer surface, thereby preventing the gas leakage.

**[0042]** Though the adhesive 55 is only applied to the portions along the line-shaped joint 40 in the aforementioned embodiment, the adhesive 55 may also be applied to portions corresponding to the circular joints 45, as shown in Fig. 4, so as to join the protective cushion element 31 and the outer shell fabrics 51, 52 at these portions. Further, the adhesive 55 may also be applied to portions corresponding to the line-shaped joints 41, 42, 43, 44 so as to join the protective cushion element 31 and the outer shell fabrics 51, 52. In this manner, the integrity of the outer shell fabrics 51, 52 and the protective cushion element 31 is improved, thereby facilitating the folding of the protective cushion 30 for protection of

vehicle occupant's head and preventing gas leakage through the seams formed by sewing the circular joints 45.

[0043] Though the outer shell fabrics 51, 52 have no projection in the aforementioned embodiment, the outer shell fabrics 51, 52 may have projections to be superposed on the projections 36.

[0044] Though the outer shell fabrics 51, 52 are separated pieces in the aforementioned embodiment, the outer shell fabrics may be outer shell fabrics 51A, 52A composed of one continuous piece as shown in Figs. 5 (a), 5(b). The piece for the outer shell fabrics 51A, 52A is folded double along the center line L and is superposed on and bonded to the protective cushion element 31 by the adhesive as shown in Fig. 5(a).

[0045] In the present invention, patch clothes may be attached to the protective cushion element 31 in such a manner that the patch clothes are superposed on the circular joints 45, but not shown. According to the arrangement, the circular joints 45 are reinforced and gas leakage through the circular joints 45 is prevented by the patch clothes. Therefore, it can avoid the necessity for bonding the outer shell fabrics 51, 52 to the circular joints 45 by the adhesive 55.

[0046] It should be understood that the present invention is not limited to the illustrated embodiments and may take another configuration than the illustrated ones.

#### [Effects of the Invention]

[0047] As described above, the present invention can provide a protective cushion for head protection which can be sufficiently prevented from gas leakage so as to maintain the inner pressure high over a lengthy period in time and, in addition, can be smoothly inflated and deployed.

#### Claims

1. A protective cushion for protection of vehicle occupant's head which is fixed at its upper portion to a portion near the corner between a ceiling and a side surface of a vehicle cabin and which is inflated downwardly along the side surface by gas, the protective cushion (30) comprising:

a cabin-side base fabric (32) and a window-side base fabric (33) which are sewn together by sewing yarns (40-45), wherein  
 outer shell fabrics (51, 52; 51A, 52A) are superposed on outer surfaces of said cabin-side base fabric (32) and said window-side base fabric (33), respectively, and  
 the outer shell fabrics (51, 52; 51A, 52A) are bonded by adhesive (55) to at least one of sewn portions formed with sewing yarns (40-45) for joining the cabin-side base fabric (32) and the

window-side base fabric (33).

2. A protective cushion for protection of vehicle occupant's head as claimed in claim 1, wherein said cabin-side base fabric (32) and said window-side base fabric (33) are sewn together along their peripheries, and

said outer shell fabrics (51, 52; 51A, 52A) are bonded by adhesive (55) to the sewn portion along said peripheries.

3. A protective cushion for protection of vehicle occupant's head as claimed in claim 1 or 2, wherein said cabin-side base fabric (32) and said window-side base fabric (33) are bonded together by adhesive (39) at portions to be sewn and then sewn together at said portions by said sewing yarns (40-45).

Fig. 1

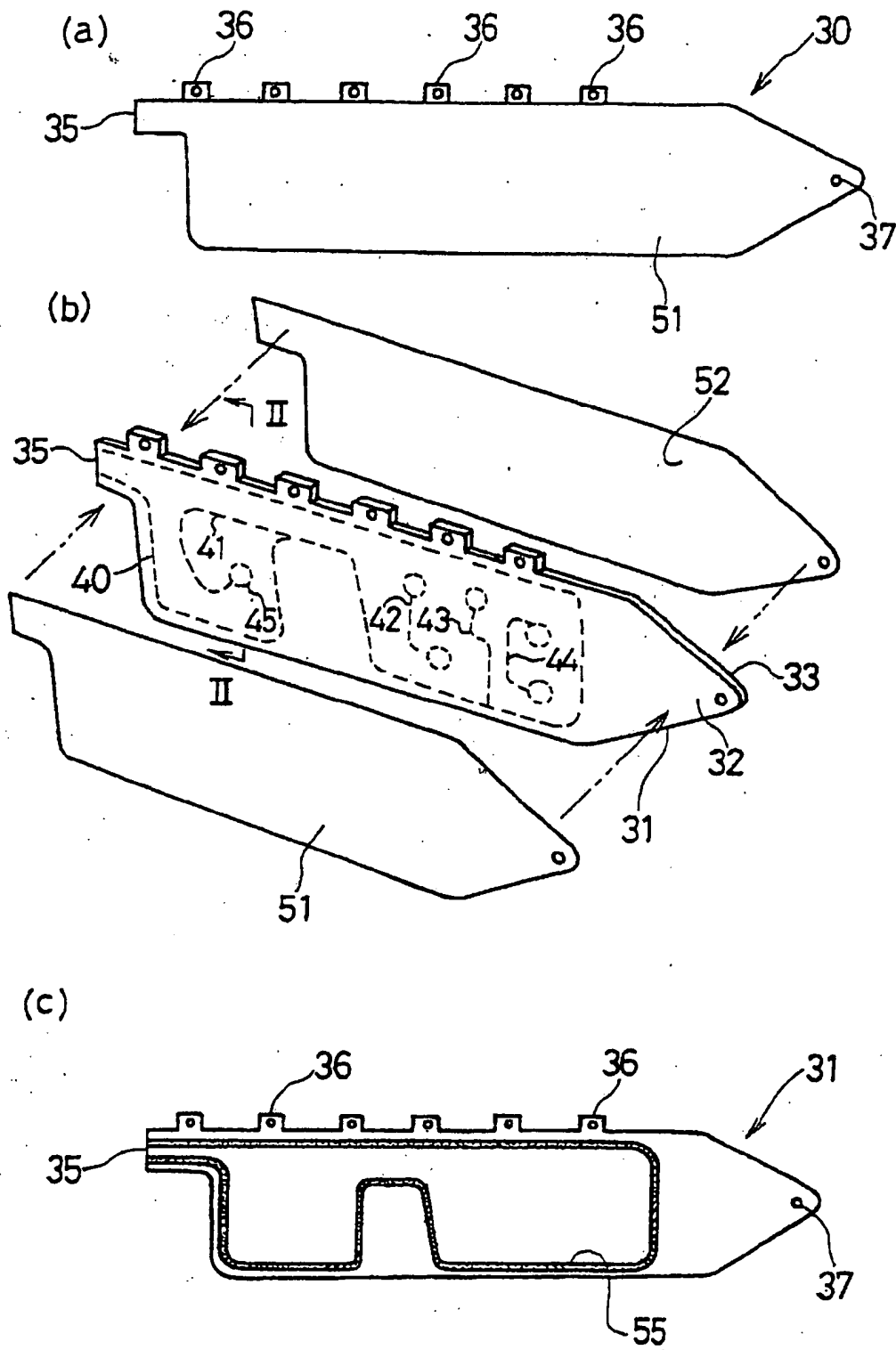


Fig. 2

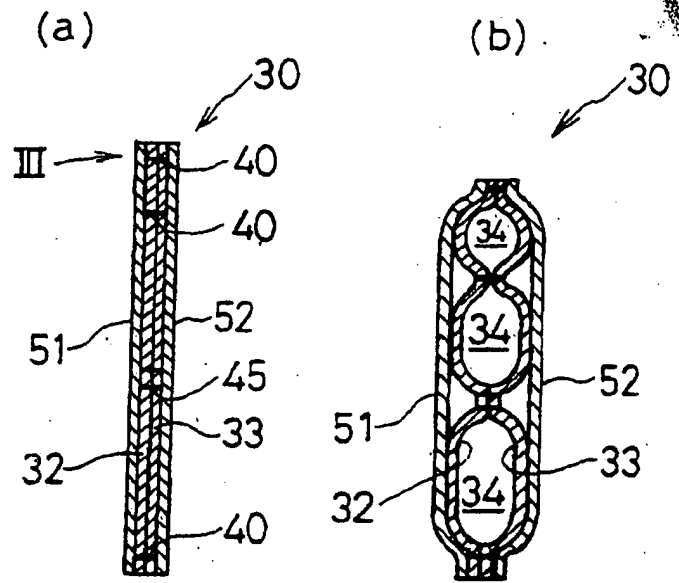


Fig. 3

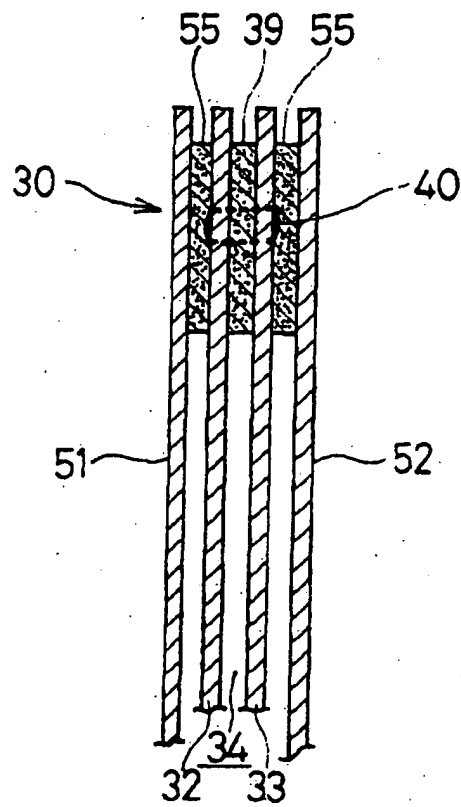




Fig. 4

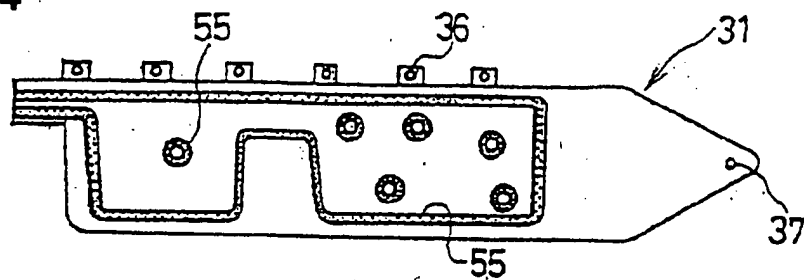
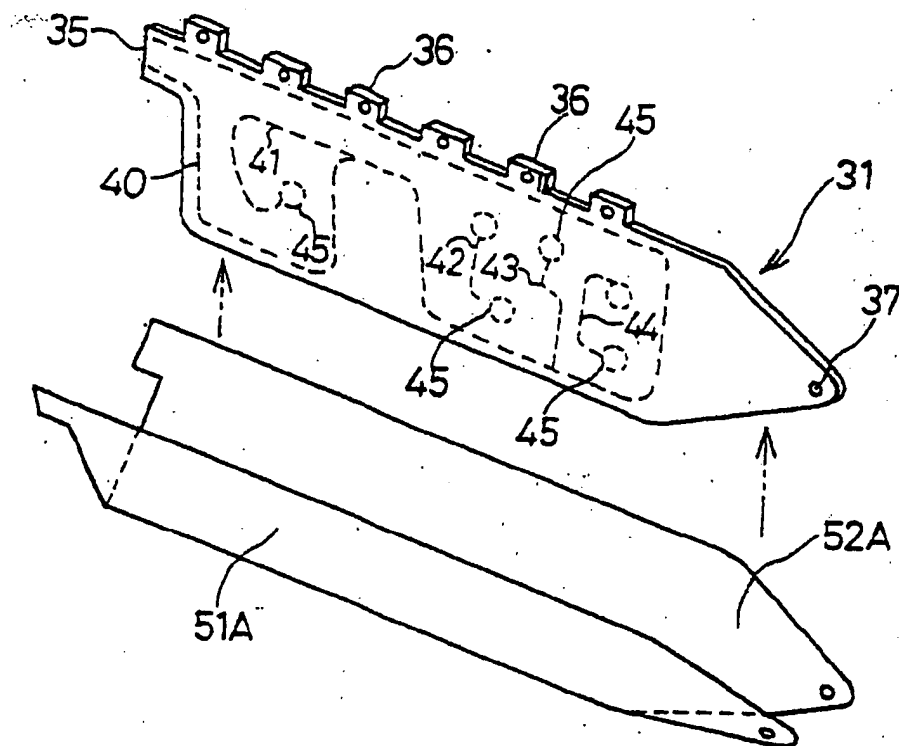


Fig. 5

(a)



(b)

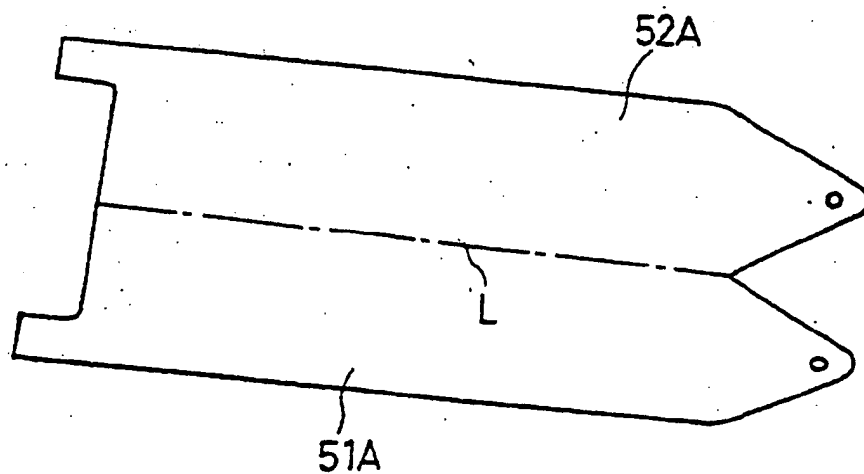


Fig. 6

